

Origin of clinopyroxene-ilmenite symplectites in mafic granulites from eastern parts of the Chotanagpur granite gneissic complex, East Indian shield

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ABSTRACT

In this manuscript, we report a rare occurrence of rod-like intergrowths of clinopyroxene-ilmenite that variably replace titanite in a suite of high-pressure mafic granulites from the Chotanagpur Granite Gneissic Complex, Eastern Indian Shield. Garnet proximal to the clinopyroxene-ilmenite intergrowth is invariably replaced with symplectic clinopyroxene-plagioclase or a rind of plagioclase. Textural modeling of the reaction textures and mineral compositions suggests that the garnet-titanite became unstable and the ilmenite-clinopyroxene preferentially develop after titanite. The presence and texture of halogen rich apatites within the ilmenite-clinopyroxene symplectite are consistent with a fluid mediated process. Thermodynamic modeling in the NCFMAST (+H₂O) system, demonstrates that the clinopyroxene-ilmenite symplectite was formed along a steeply decompressive retrograde *P-T* path (from ~13 to ~7 kbar, at ~800 °C), in the presence of partial melts. The study demonstrates that relative to Fe, Mg, and Ca, Ti was less mobile and that the mobility of Ti was restricted within the confines of titanite being replaced by the clinopyroxene-ilmenite symplectite. This study implies that besides the ligand activity, the fluid/rock ratio exerts a strong control on the length scale of Ti transport in natural rocks.

Keywords: Clinopyroxene-ilmenite symplectite, high-pressure metamorphism, CGGC, textural modeling, CSpace, XmapTools, Ti mobility